

2007

# Portable Space and Interior Design for Dentists

Yu-Ping Liu

*Virginia Commonwealth University*

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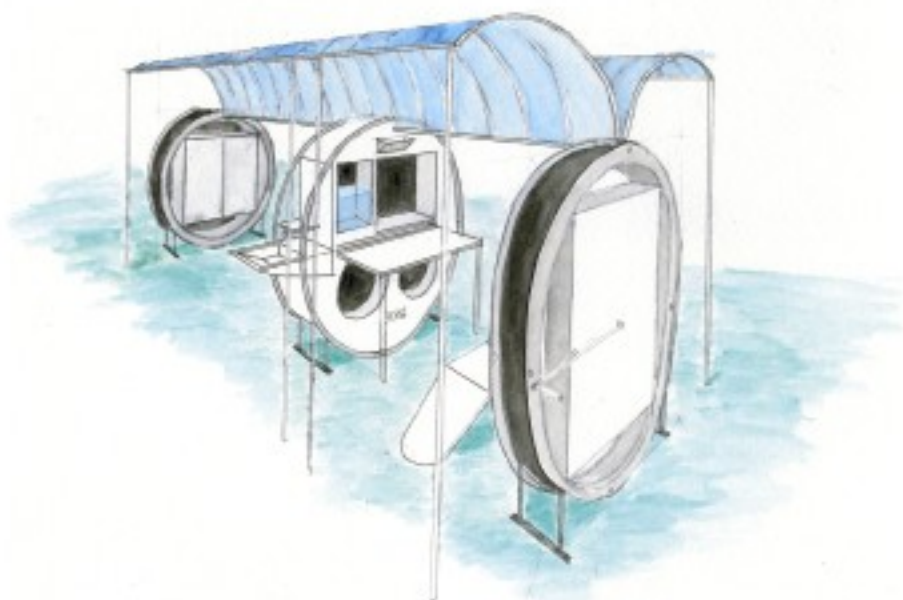
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## Portable Space and Interior Design for Dentists

Documentation submitted in partial fulfillment of requirements for the degree of Master of Fine Arts at Virginia Commonwealth University



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## **Acknowledgements**

I would like to thank my father, mother and brother, whose tremendous love and support made this journey possible.

I would like to thank my thesis advisor, Camden Whitehead and Lucinda Kaukas Havenhand, for their encouragement and inspiration. I want to thank Professor Wen Andrew, for his kindness and warm heartedness. I would further like to thank all faculty at Virginia Commonwealth University for their guidance and provide nice environment for study.

I would like to thank for all the wonderful memory of studying abroad which has been given by all my friends, especially Masa, Corina, Bert, Catherine Grottenthaler, Katie Thomas, and Anisa.

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Introduction

## Introduction

In the United State today, many people do not have access to adequate dental treatment, while tooth decay is the single most common chronic childhood disease—five times more common than asthma and seven times more common than hay fever.<sup>1</sup> At the same time, studies show that 80% of dental illness takes place in 25% of the population, which is comprised mostly of lower socioeconomic groups.<sup>2</sup> A study undertaken by the National Health and Nutrition Examination Survey in 2000, concludes that poor children suffer five times as much tooth decay as their more affluent peers. Furthermore, in poor children with tooth decay, almost 80% remain untreated.<sup>3</sup> Poor dental health therefore is a major health concern for under privileged families.

In 2002, the National Conference of State Legislatures conducted a survey on barriers to access to oral health care for low-income people in five states.<sup>4</sup> An unequal distribution of dentists, with too few in rural, frontier, and border areas was cited as one of the root causes of poor dental health in low-income populations. In addition, the survey discovered that there is a shortage of dentists who are willing to treat low-income clients, particularly those insured by Medicaid. The survey also indicated an inadequate public health infrastructure or safety net for dental care. The few community health centers that have dental clinics and the publicly or privately funded dental clinics are therefore overwhelmed.

How to bring proper dental care to low-income and rural Americans therefore is a major question that the health care system in the United States needs to address. Many individual donors and private foundations have attempted to remedy this situation by holding free programs in rural areas and schools all over the United States.



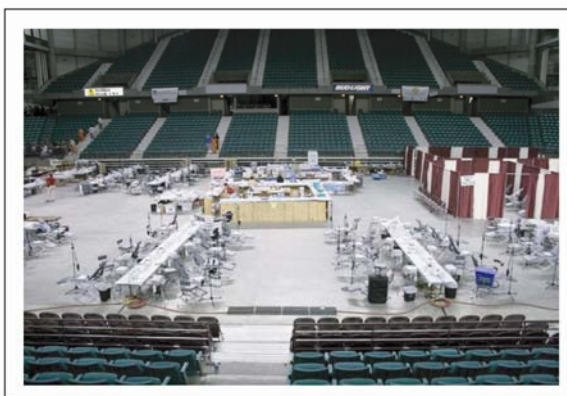
For example, the Virginia Dental Association created the so-called Missions of Mercy in 2006 to help more than 1,400 patients receive care in the bustling 65-chair dental clinic at the Wise County fairgrounds, Virginia.

Charitable dental services like these usually take place in vans, tents or available empty spaces. While the mobile dental van provides an excellent way to get services to remote and diverse areas, the cost of fit-up of the vehicles is high and the space inside is limited to two working stations only. At the same time dental care units set up in temporary space, usually have a disorderly quality that make clients easily nervous, lower the quality of medical treatment, and boost the possibility of infection.

The way these temporary dental care spaces are designed and delivered therefore can greatly increase or decrease their success. The goal of this project, then is to enhance and facilitate the delivery of better dental treatment by designing a new prototype for a portable dental office that will be more flexible and more usable in a variety of situations and locations. For the purpose of this study, this prototype will be considered or tested within the context of three different types of spaces: the single closed room; a large open public space; and within mobile and nonpermanent structures such as tents.

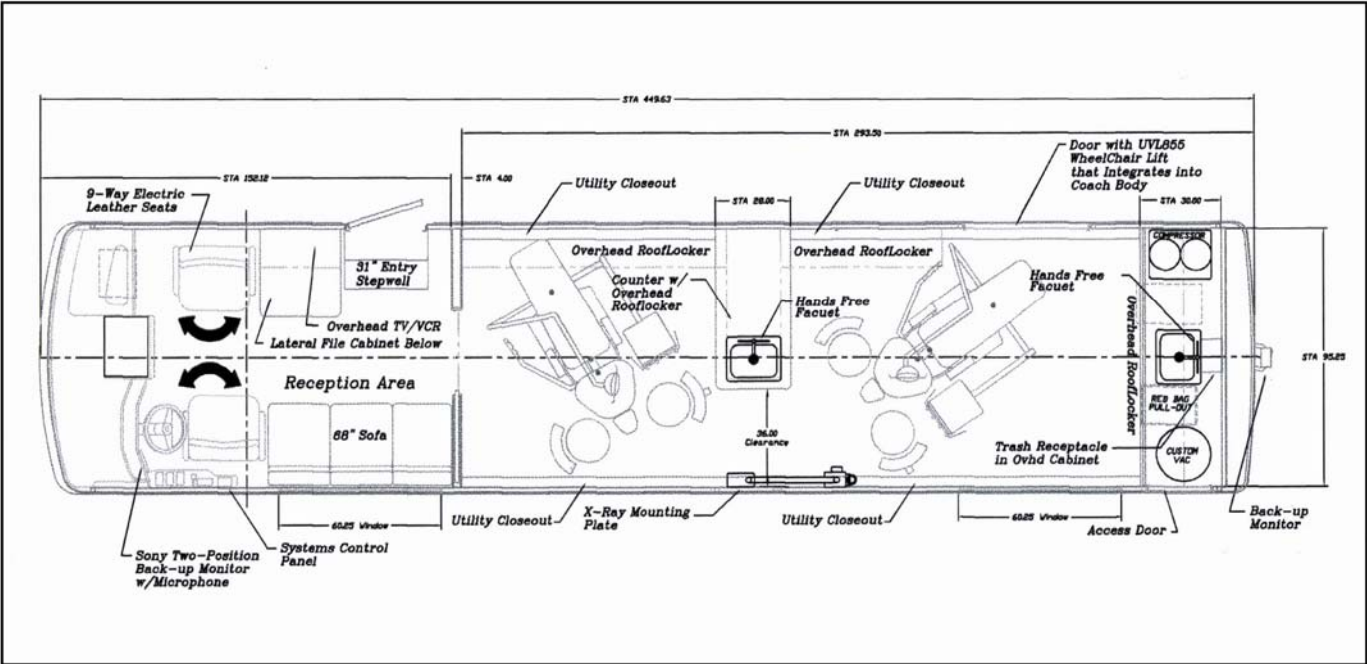
Several aspects of working conditions specific to the dental office will be taken into account when developing this design including transportability, degree of flexibility, storability, hygiene, and the creation of a relaxing atmosphere all of which greatly impact both the dentists and patients experience and are essential to the creation of a successful portable dental office.

1. U.S. Department of Health and Human Services (HHS). *Oral Health in America: A Report of the Surgeon General*. Rockville, MD: HHS, National Institutes of Health, National Institute of Dental and Craniofacial Research, 2000.
2. Kaste, L.S.; Selwitz, R.H.; Oldakowski, R.J.; et al. Coronal caries in the primary and permanent dentition of children and adolescents 1-17 years of age: United States, 1988-1991. *Journal of Dental Research* 75:631-641, 1996.
3. <http://www.cdc.gov/nchs/about/otheract/hp2000/oralhealth/oralcharts.htm>
4. Shelly Gehshan and Tara Straw, *Access to Oral Health Services for Low-Income People—Policy Barriers and Opportunities for Intervention* for The Robert Wood Johnson Foundation, 2002.





Mobile Dental Van



## **Portable Dental Office List**

### **Waiting Room**

2500-3000 sf.

seating: 150-200 foldable chairs

### **Reception area**

200 sf.

reception desk: 4-5 assistants work here.

### **Supply center**

2000 sf.

Foldable tables: The quantity depends on the situation

### **Treatment Room**

100-120 SF. per unit room

dental units: 50 units

stools: 1 for the dentist, 1 for the assistant per unit

chair: 1 patient's chair per unit

sinks: 1 sink for two units

mobile carts :1 cart per unit

modular cabinetry: 1 cabinet for two units

Built into these units are dispensers for drinking cups, several sizes of gloves, tissue boxes, and sharps containers.

water systems: 1 water system for 2 units

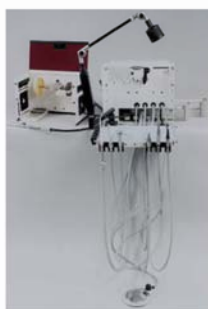
Due to the fact that water can be easily contaminated, it is necessary to design a independent water system that can be filled with distilled water.

electricity: 3 outlets per unit

lighting:1 general light and 1 focal light per unit

### **Storage**

500 sf.





Site Analysis

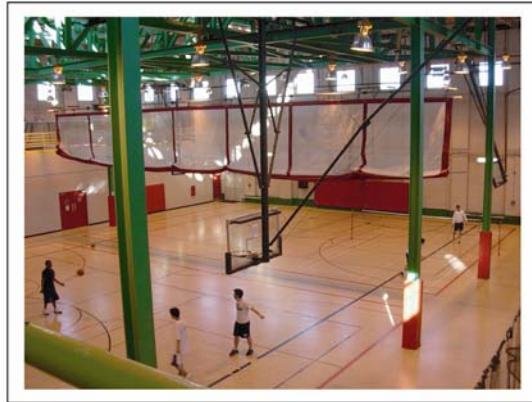
## Cary Street Gym

The gym is located on Cary Street, on the campus of Virginia Commonwealth University, Richmond, VA. It is about 19200 sq feet, including: a basketball court, changing rooms, restrooms, a lounge and a gym on the ground floor; a studio and squash courts on the second floor. To find out if the portable dental units can fit in any space, the basketball court was taken for the analysis of a large open public space; the studio and squash courts were taken for the analysis of single closed rooms.

There are eleven treatment areas, six areas on the first floor and 5 areas on the second floor. When the clients come in from the entry on the first floor, the receptionists will show them the treatment process and direction. The clients will sit in the waiting area and wait their turn.



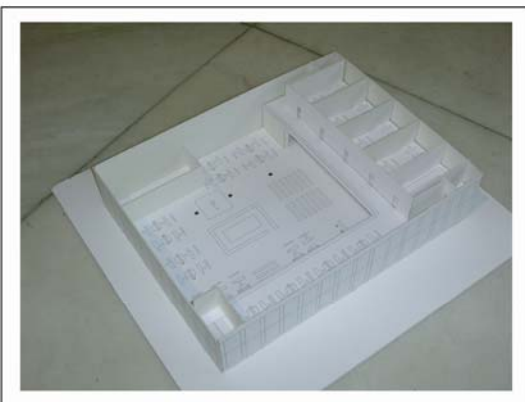
**Exterior**



**Basketball Court**



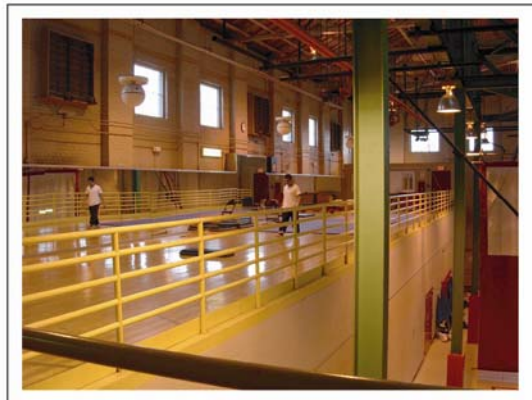
**Basketball Court**



**Model**



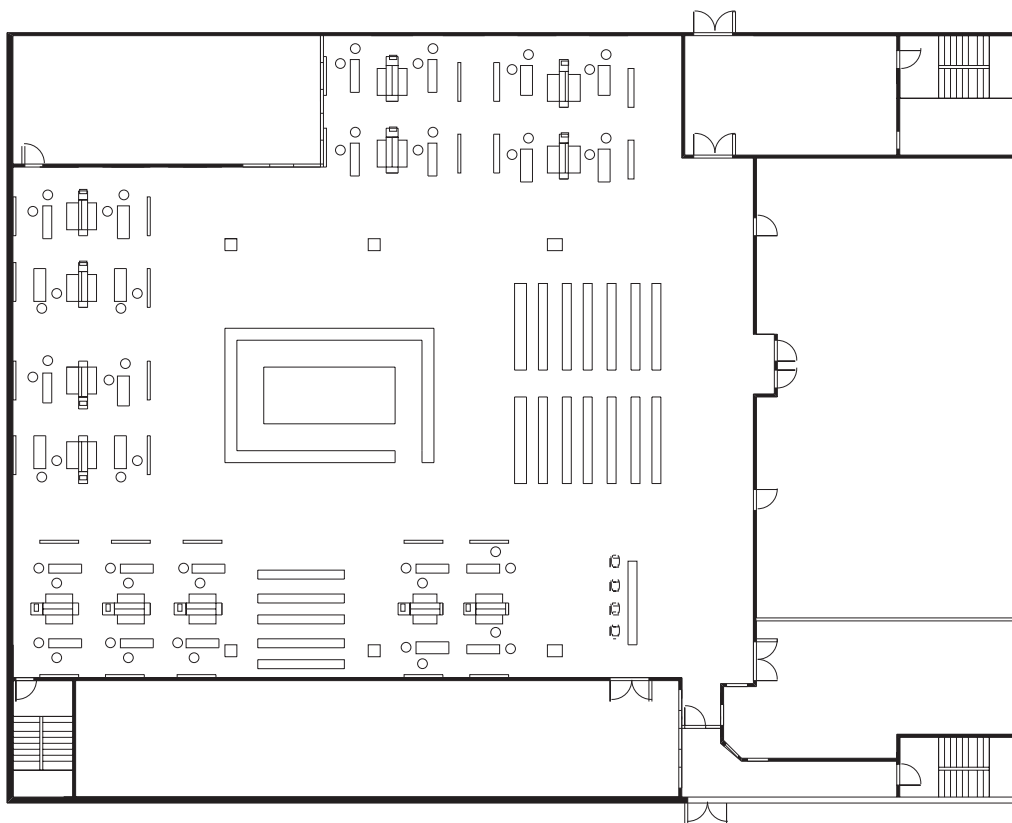
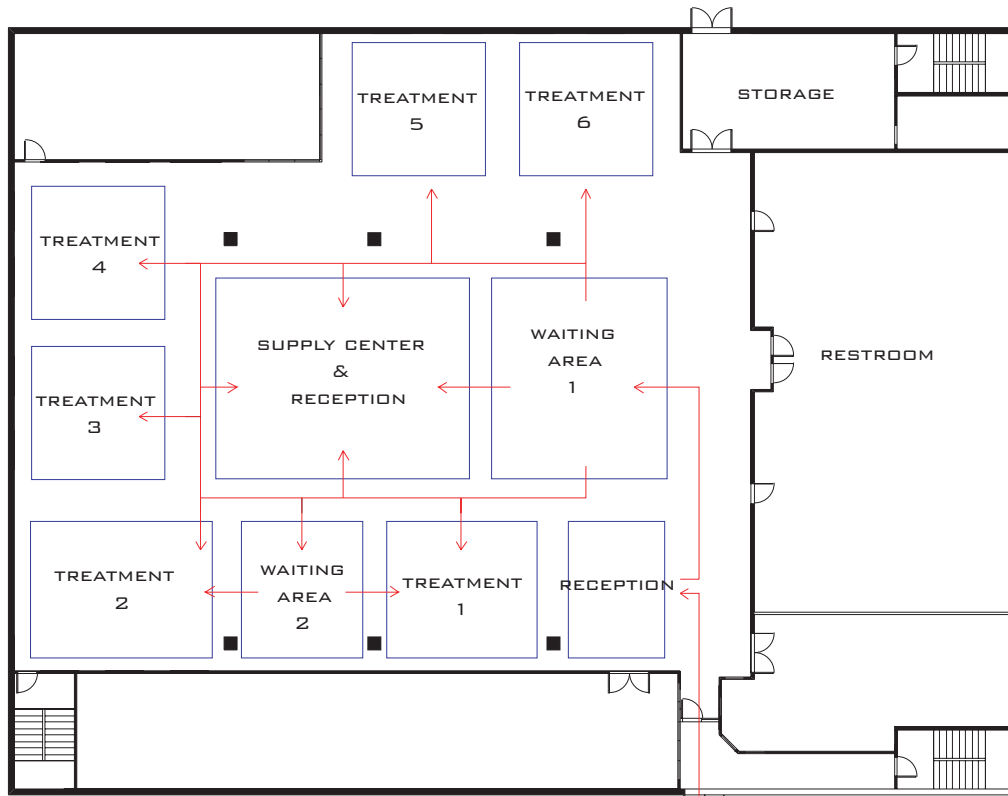
**Hallway on 2F**

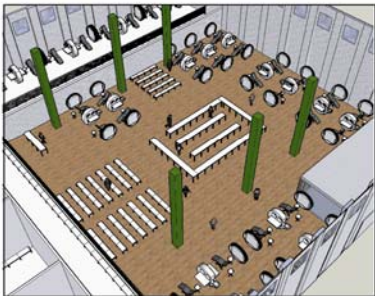
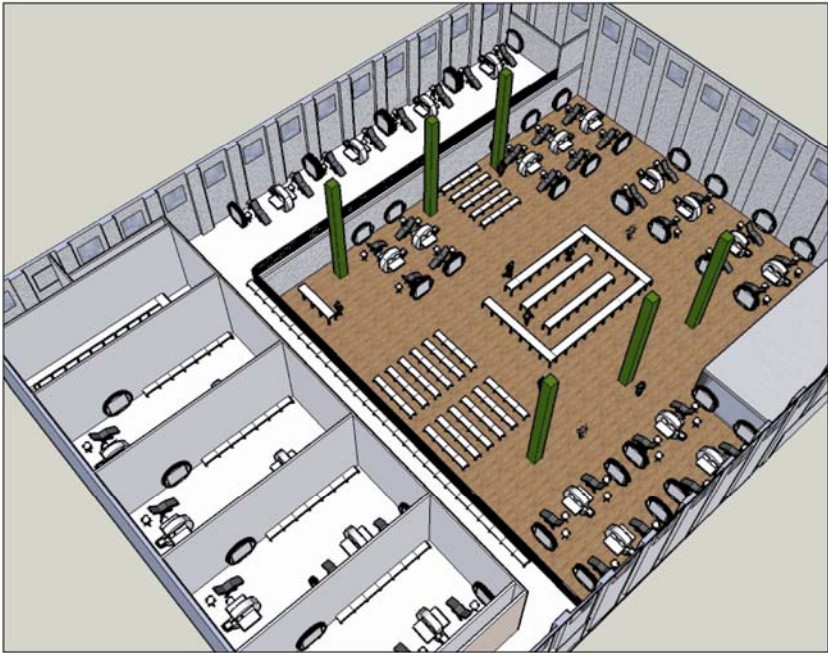


**Studio on 2F**

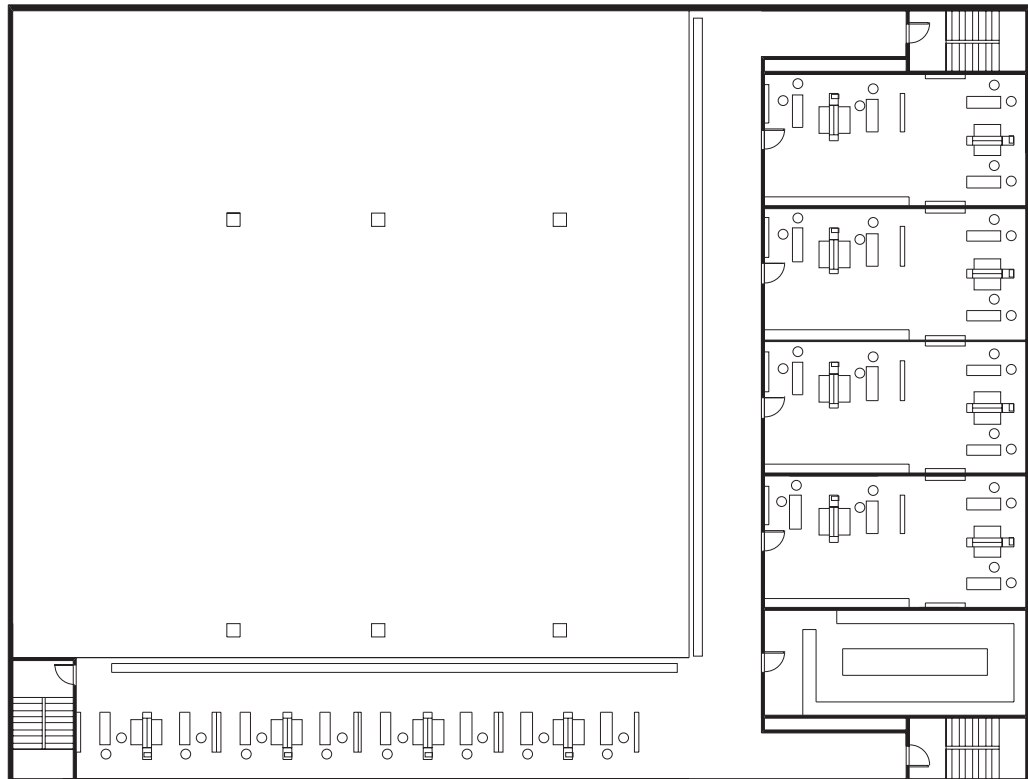
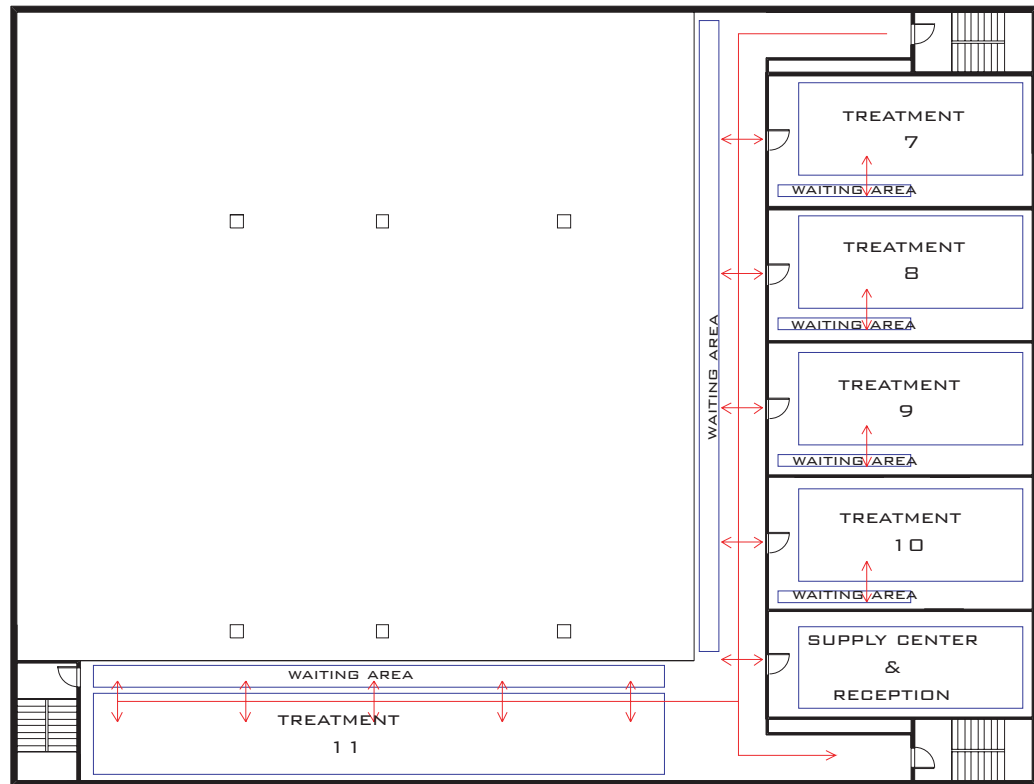


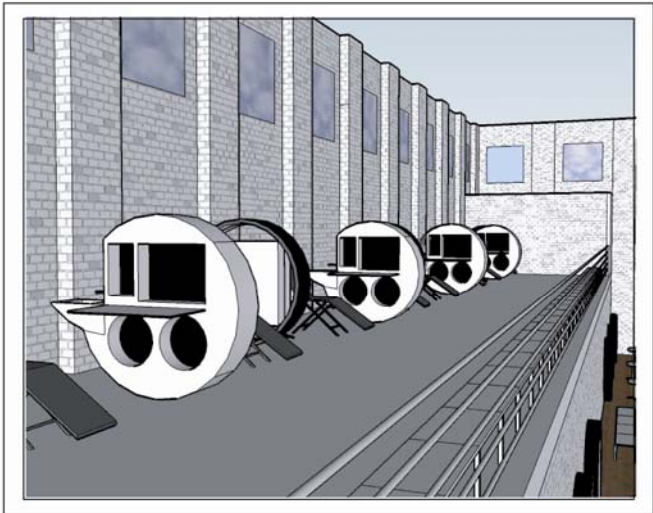
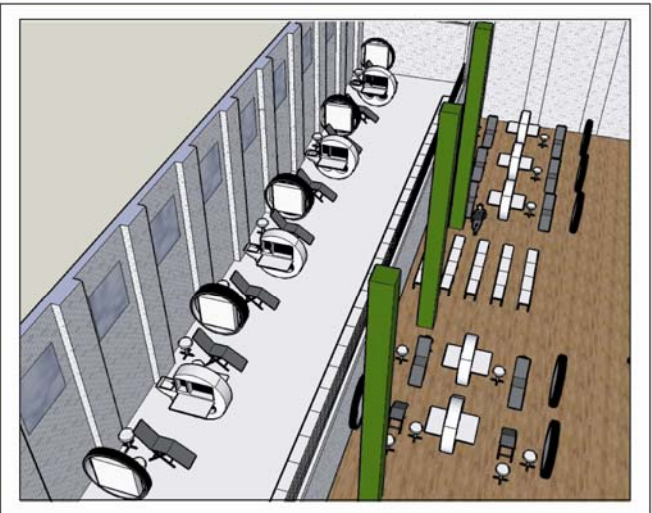
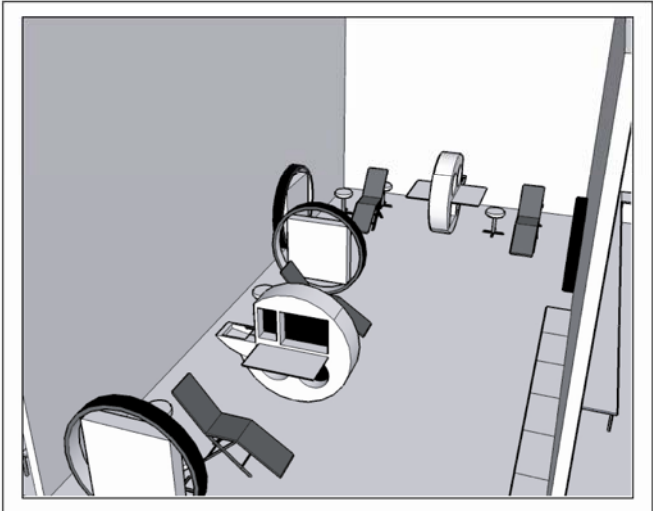
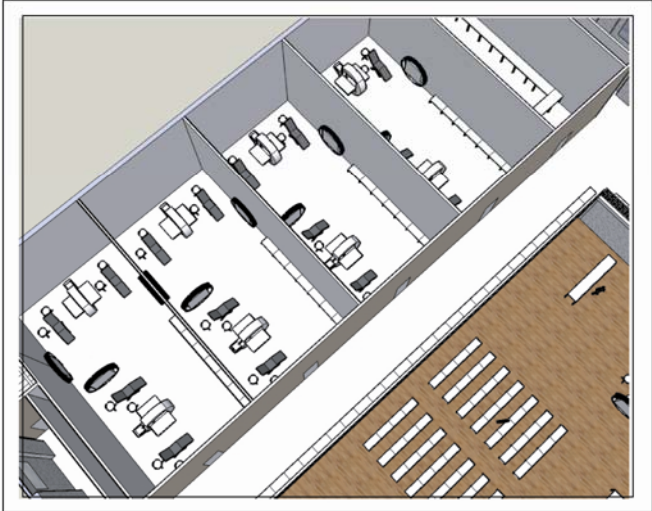
1F





2F





Literature Review



**Project**

Markies

**Date**

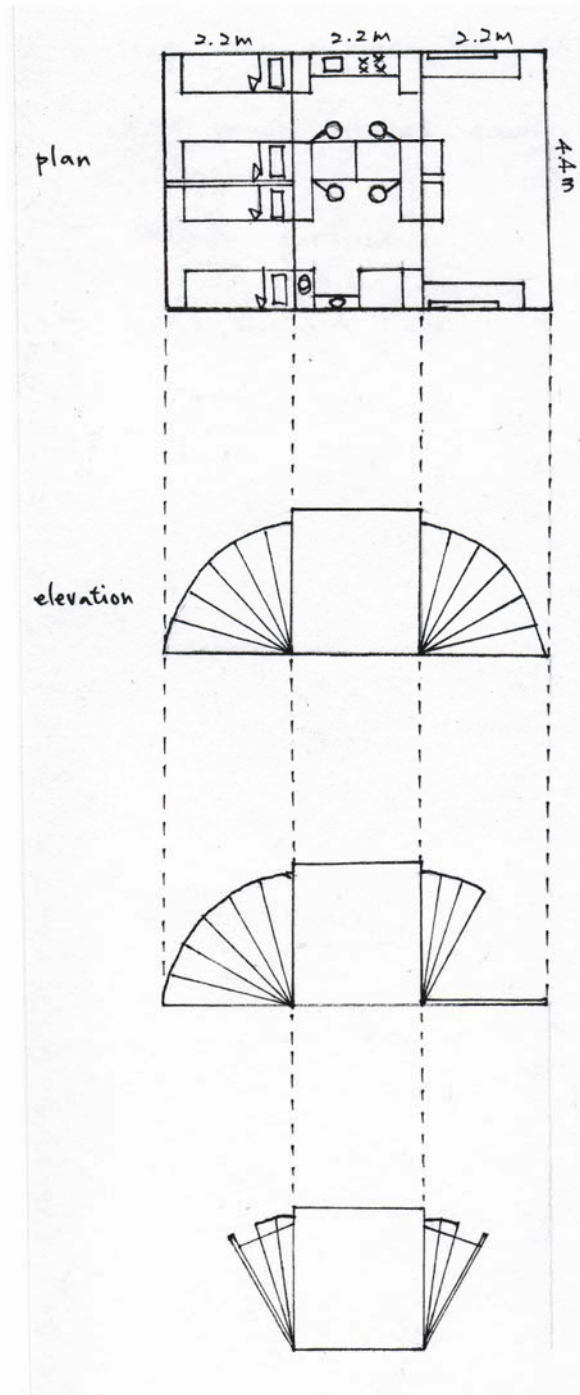
1986-1995

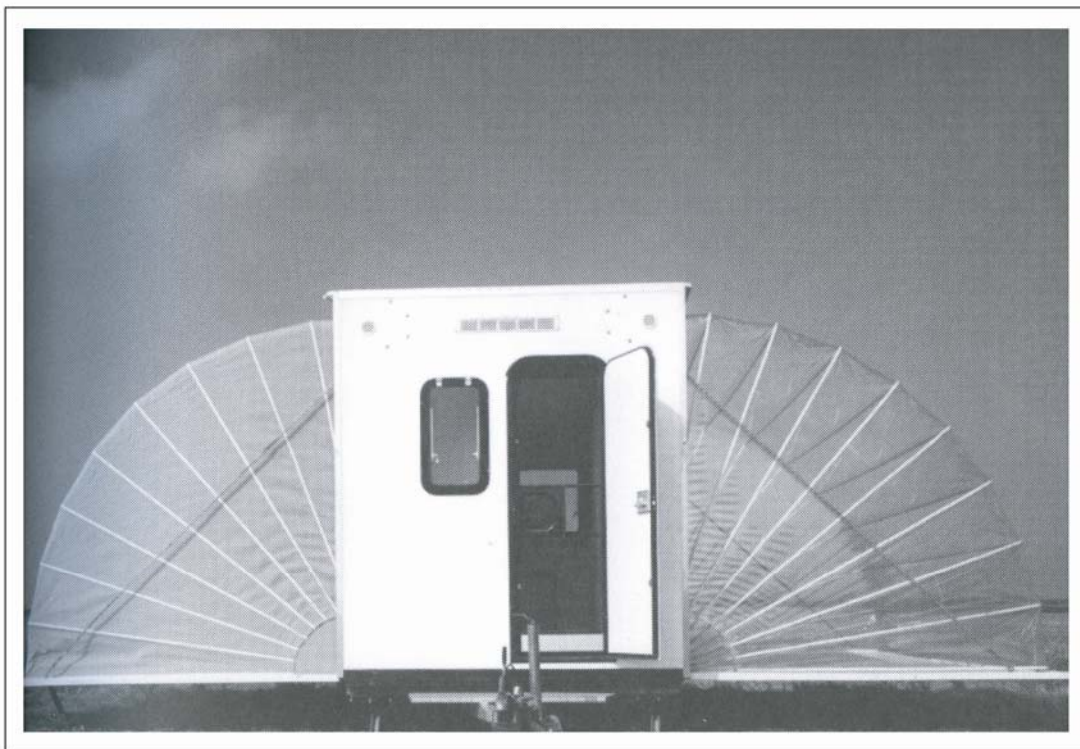
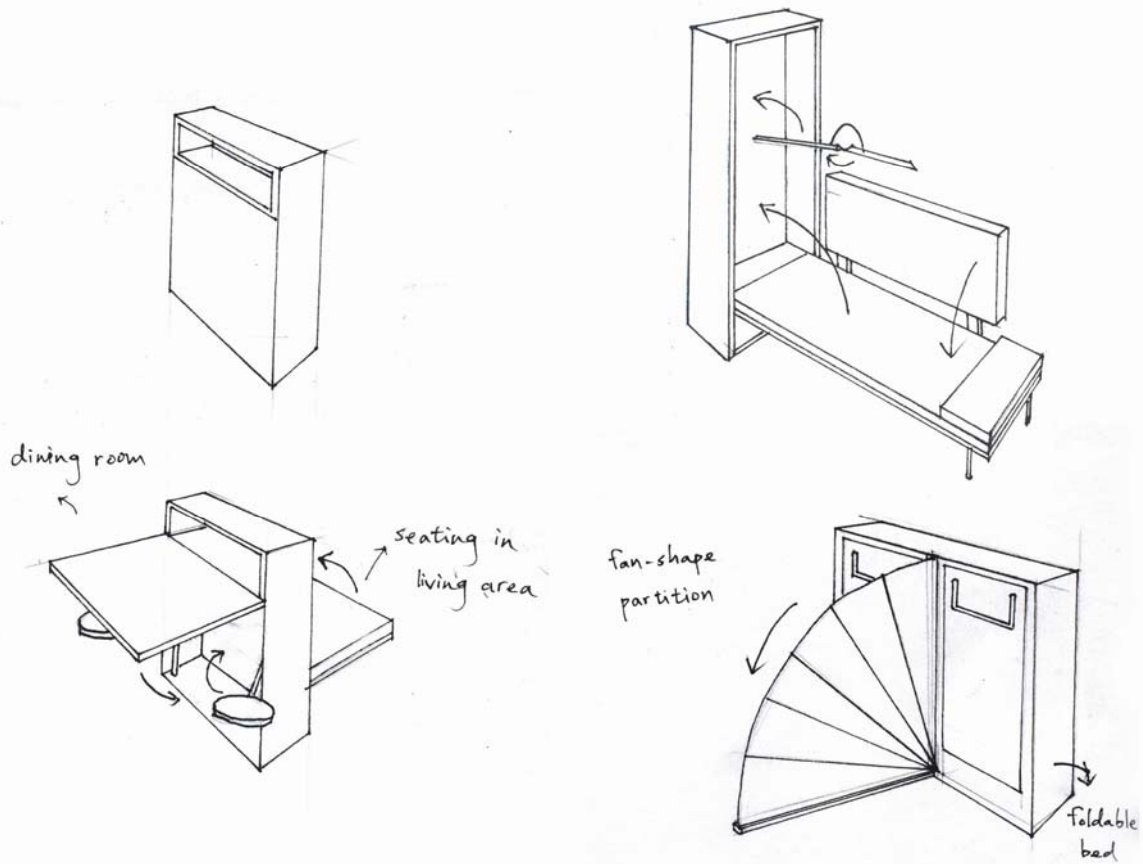
**Designer**

Eduard Bohtlingk

**Introduction**

Markie is a fold-out holiday house, designed on the principle of "temporary homes are mobile homes" by Eduard Bohtlingk. It is highly mobile, in terms of weight and size. When folded up, the surface area is  $2.2 \times 4.4$  m, which meets the requirements for traveling on the roads. The central part is made of 30 millimeters thick sandwich panels with a polyester top coat, which includes fold-away furniture, a fridge, a cooker, a toilet and shower facilities. The folded-out canopies on two sides of the central area create the sleeping quarters on one side and the living quarters on the other. The interior consists of fold-out benches, beds, and tables. The dark orange canvas canopy covers the sleeping quarters while the transparent PVC sheaths the living quarters. They can be opened up in good weather and adjusted to any angle to provide shade. A foldable fan-shaped partition divides the sleeping area of four beds into two sections.



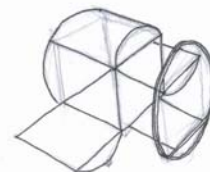
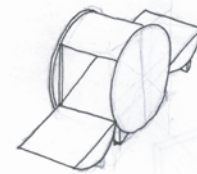
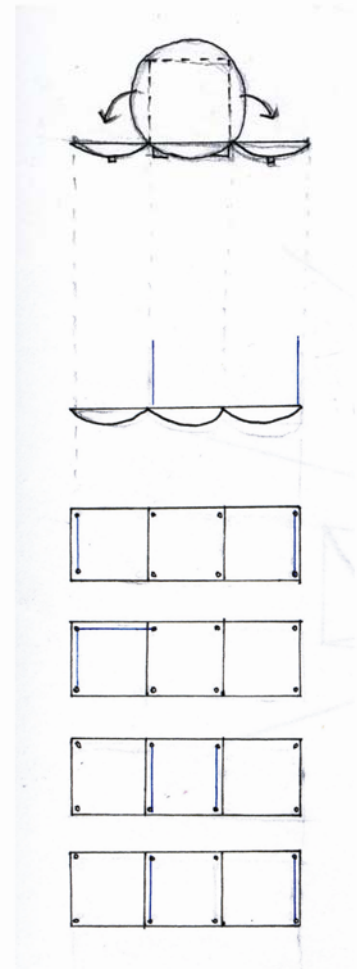


**Project***Mobile Porch***Date**

2000

**Designer***Kathrin Bohm, Stefan Saffer, Andreas Lang***Introduction**

Mobile Porch is a mobile architectural unit, an object which can be spread out and used in many ways, ranging from a picnic site to a shop, and from an arts platform to a bar. The unit is an aluminum drum clad in triplex with a diameter of 2.3m and a length of 2.1m when it is folded up. The drum sits on two wheels and is small and light enough for two people to move. Once located, the wheels can be removed to make the floor surface larger when it is spread out and the panels can be folded out from the drum and arrange in various position.





**Project***Mobile Linear City***Date**

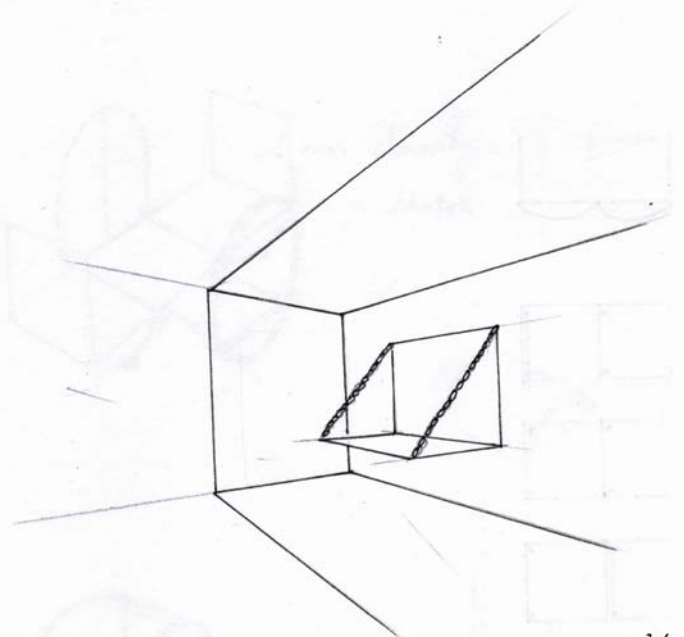
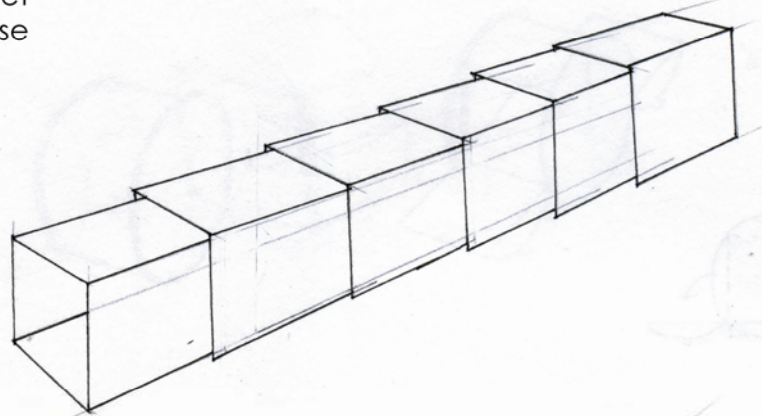
1991

**Designer**

Vito Acconci

**Introduction**

Mobile Linear City comprises six housing units telescoped together into a trailer and hauled by a tractor. Once parked, the six units can be pulled out and the panels on the wall can be folded down into tables, benches, beds, racks, and more. Light comes through either the windows or the steel grid floors. The designer, Vito Acconci, thinks that a public space is dynamic rather than stagnant, so it is unnecessary to install permanent facilities for personal needs. Correspondingly, the main material of the Mobile Linear City is corrugated sheet which provides a cold quality and no sense of intimacy at all.



**Project**

*paraSITE*

**Date**

1998-present

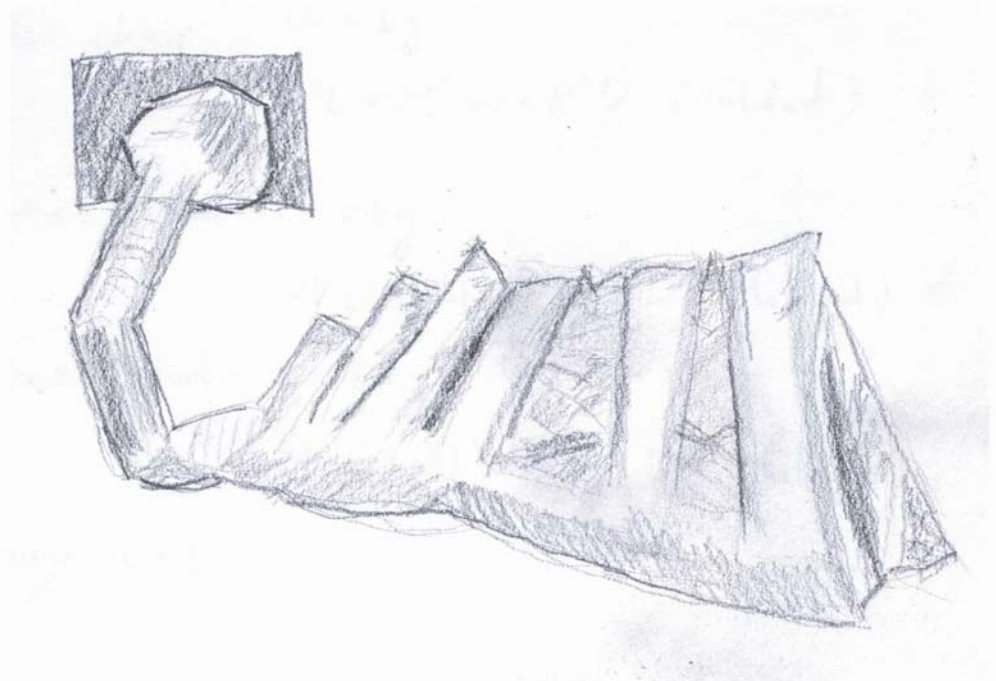
**Designer**

Michael Rakowitz

**Introduction**

There are over 4,400 homeless people living unsheltered on the street and seeking refuge every night. In response to this situation, Michael Rakowitz designed temporary shelters, called paraSITEs, for people living on the street. Nowadays, more than 30 prototypes of the paraSITE shelters are distributed through New York, Boston, and Baltimore.

ParaSITEs are inflatable and made of plastic bags and tape, which are easily attainable materials for the homeless. A series of interconnected hollow tubes make up the framework, with a tube tailing at one end. To inflate, the tube is connected to the exhaust duct of a heating or ventilation system of a building. The warm exhaust air will fill the tube to provide heat and shelter. It's easy to deflate the structure and pack it away. It provides a more self-sufficient lifestyle and calls attention to the situation of lives of the homeless on the street.



**Project***Miele Ruimtestation***Date**

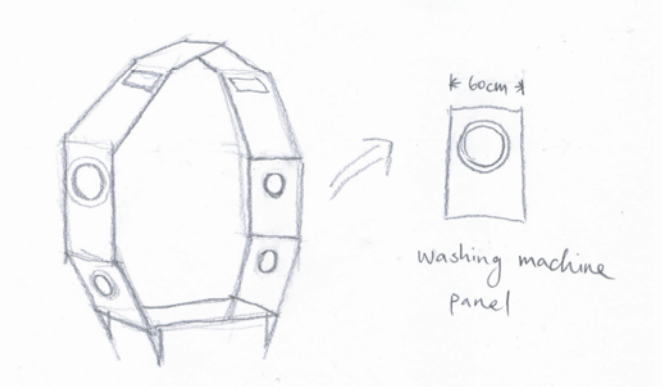
2003

**Designer**

2012 Architecten

**Introduction**

The Miele space station is a multifunctional mobile unit made entirely of washing machine parts. The design team, 2012 Architecten, wanted to transform used machine parts, source of energy, existing building into design. Each unit is compounded out of five modules, which can be rolled through a standard door of 210\*70cm and be lift by two people. These segments of the modules have a fixed width of 60cm because of the standard of washing machine. Once on site, the modules can be placed in various position and served for different functions. The space station can be used as a pavement café, a music shop, a bar or even a mobile office.



**Project**

139 shelter

**Date**

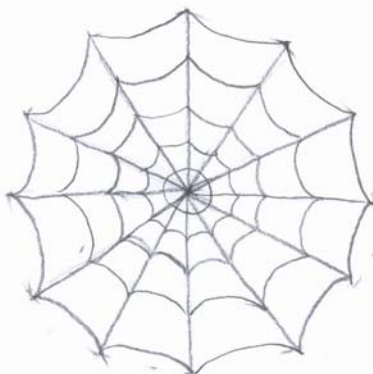
1989

**Designer**

Jan Kaplicky, David Nixon

**Introduction**

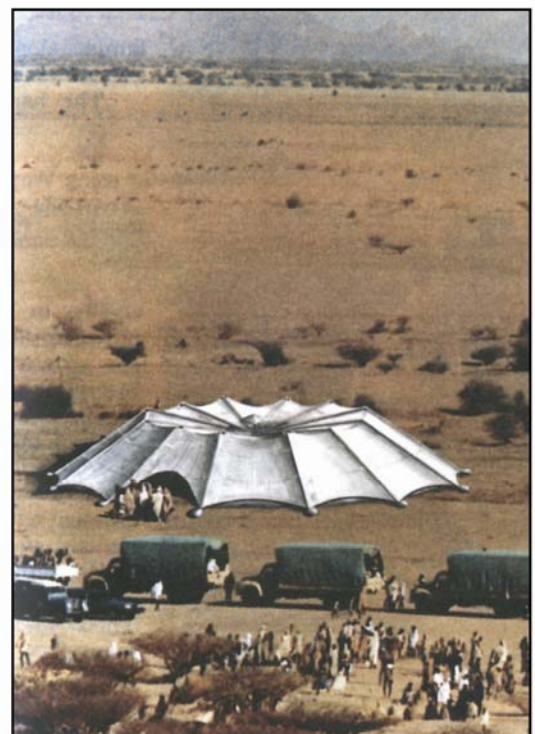
In response to the drought and internal conflict which led to widespread famine throughout Ethiopia in 1989, Jan Kaplicky and David Nixon designed the 139 Shelter to serve as supply distribution centers. The shelter is based on the principle of a woman's parasol, which is easy to transport and open, and can be hooked to a truck or airlifted to the site. Once on the site, it can be assembled by 12 people with the turn of a winch in 30 minutes and has capacity to hold up to 200 people. The lightweight PVC-coated polyester reflects 80 percent of the sun's heat and retains warmth during the night, keeping the inner temperature at a comfortable level in most of the time. The central hub provides ventilation and ensures the air quality inside.



folded



PLAN



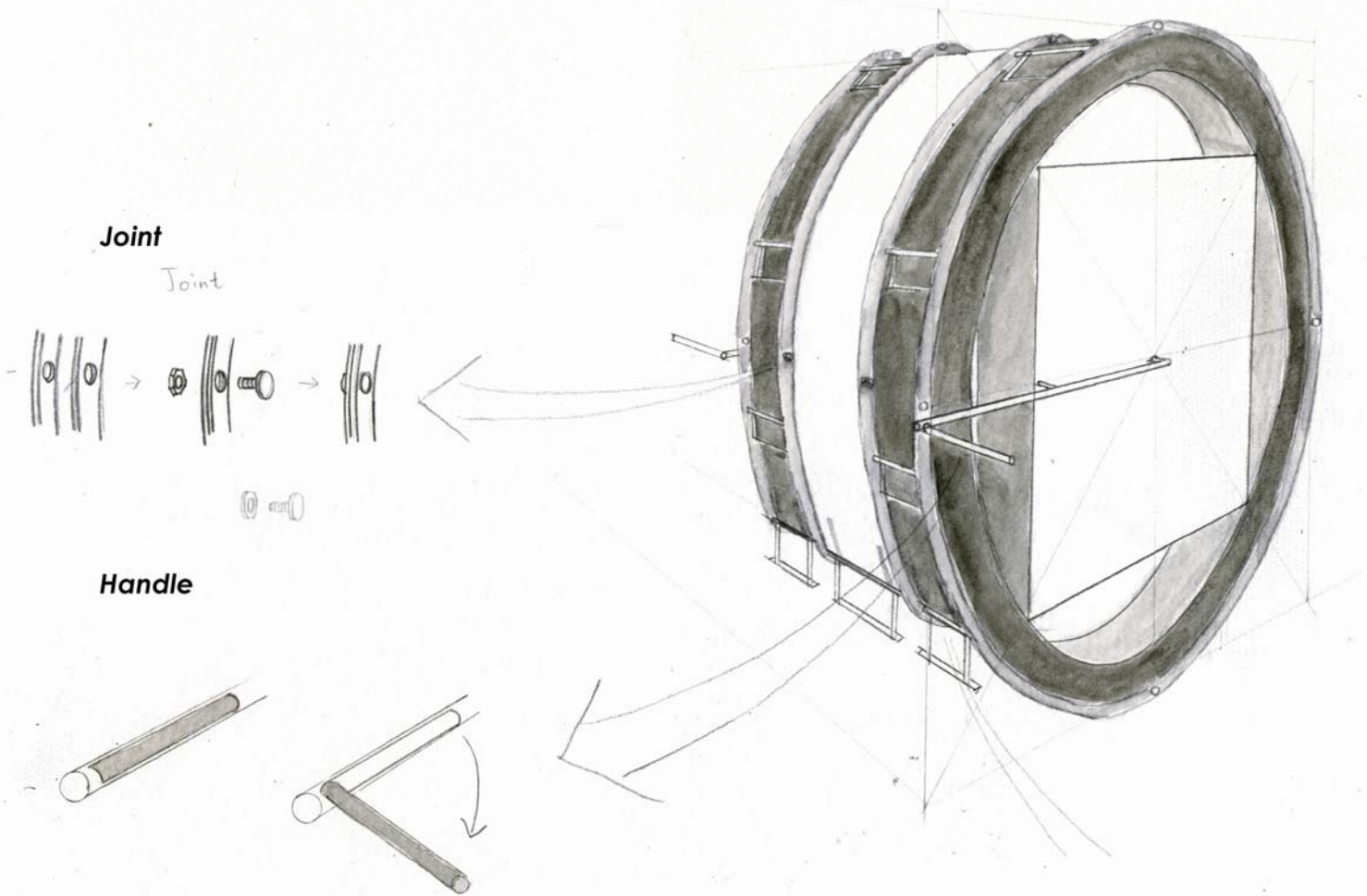
Project



## Project Introduction

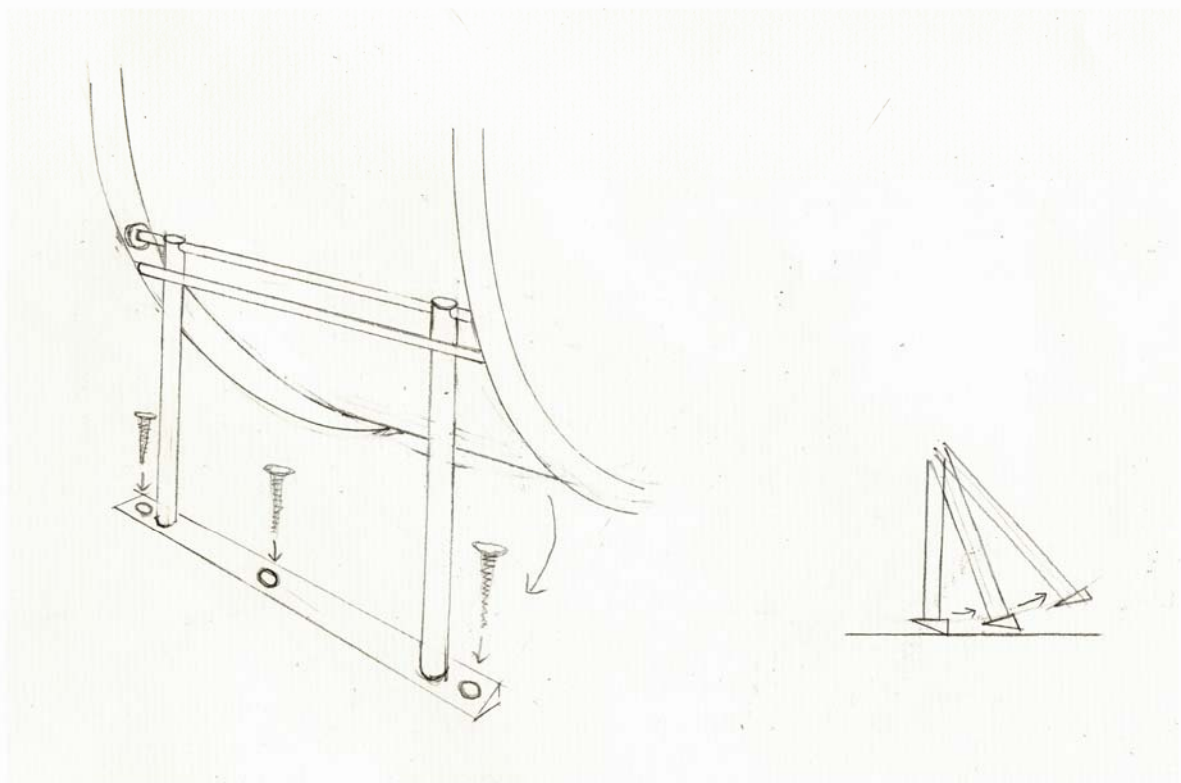
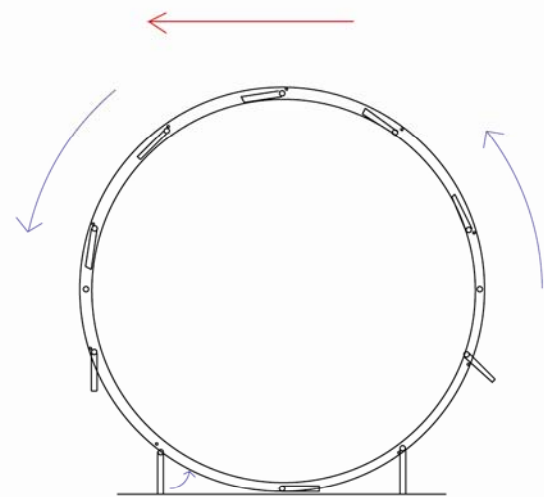
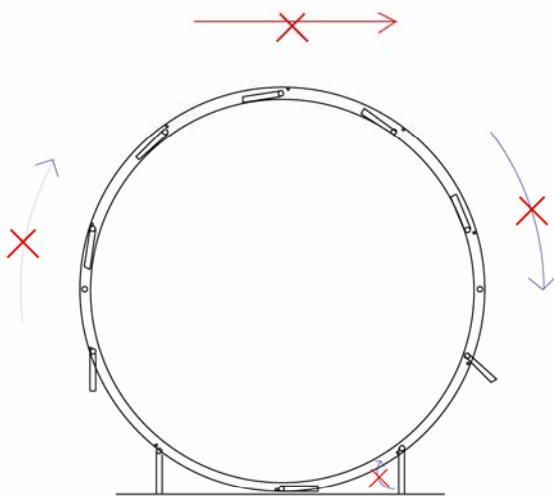
To store different kinds of equipments, the unit is divided into two segments: inner and outer parts. The inner part stores things which are strong enough to resist shaking and rotating, such as chairs, water containers, telescope sticks, a sink and a cabinet. The outer part stores equipments which need to be transported stably and cautiously, such as portable dental delivery unit.

Two parts can be combined together simply by joints and rotated with handles. Once arriving the destination, the unit can be spread out and serves as two dental treatment areas. The tent structure can be pulled out if the treatment is held outdoors.



## Stands

The stands keep wheels rotating toward front rather than scrunching people in the back. Once located, the stands could bolster the wheel. Furthermore, it can be nailed down into the ground if needed.





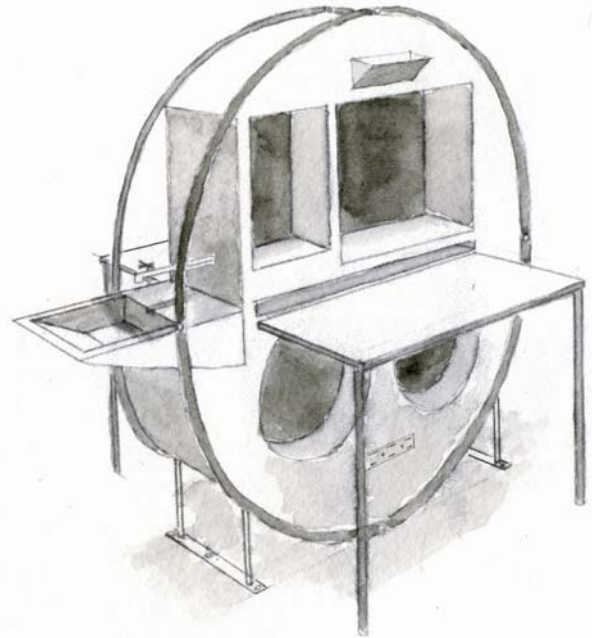


Inner Part

## Inner Part

This part is framed by Aluminum Alloy with 6.4 feet in diameter. The body is made of PVC with 6 feet in diameter. These materials are chosen for the characteristic of lightness and firmness.

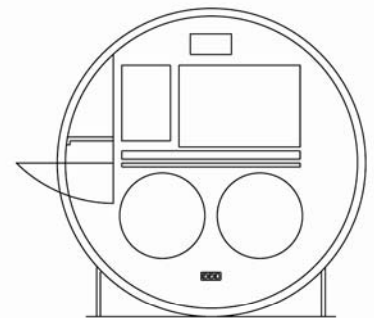
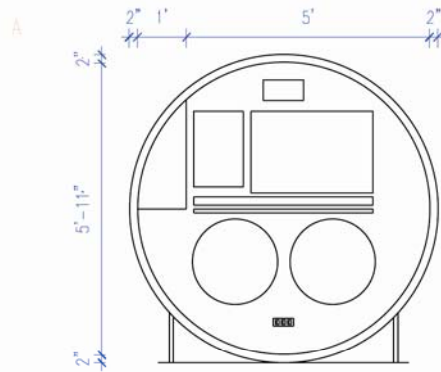
The station could launch both sides into two treatment areas. Each side has their own lighting, a table, two stools, a patient chair, and 3 outlets. The sink and cabinet are shared by both areas.



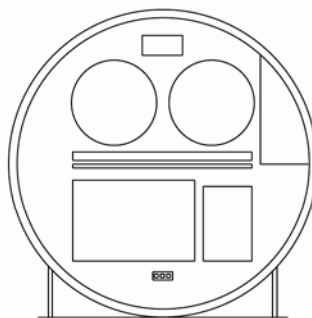
## Plan



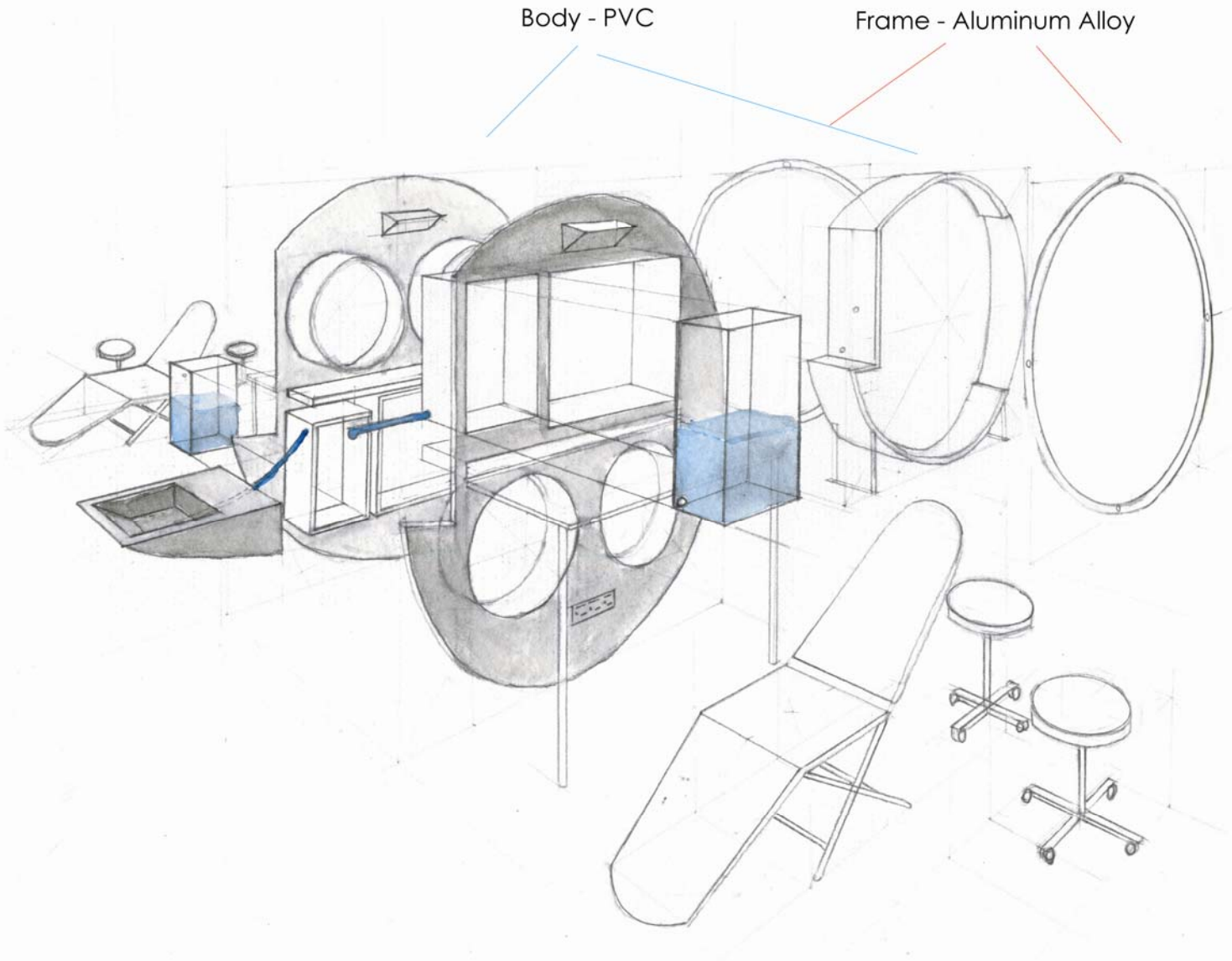
## Elevation



B

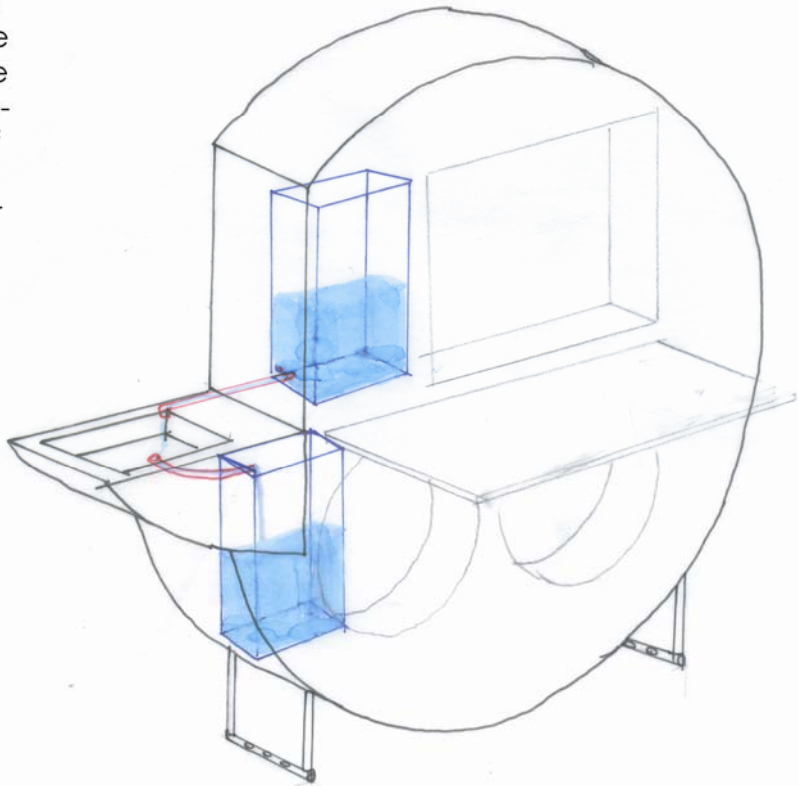
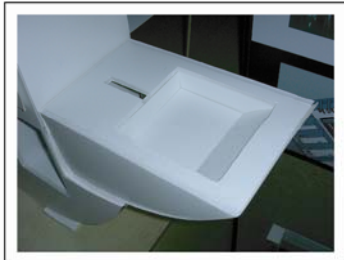


Parts

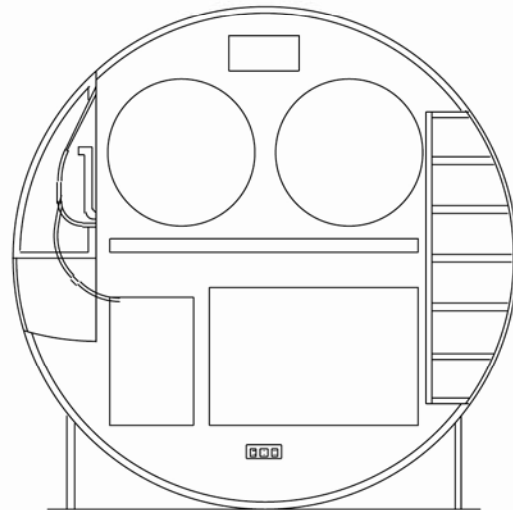
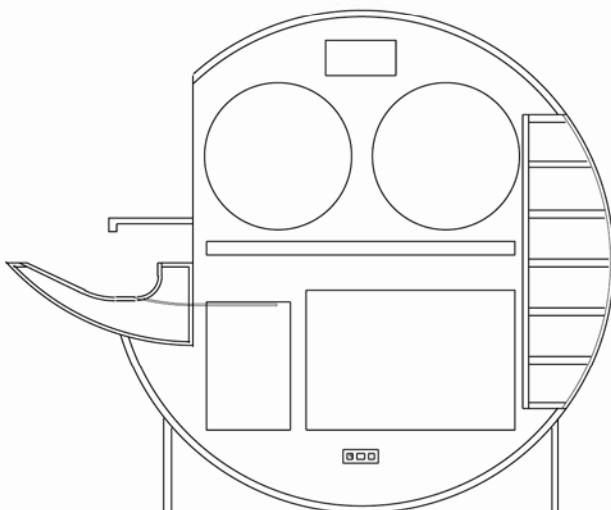


## Sink

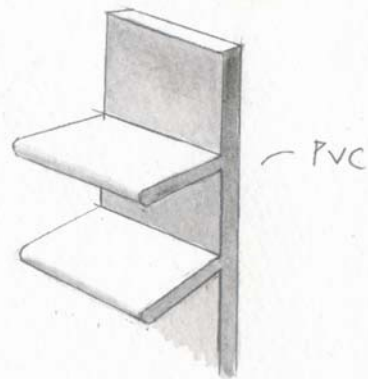
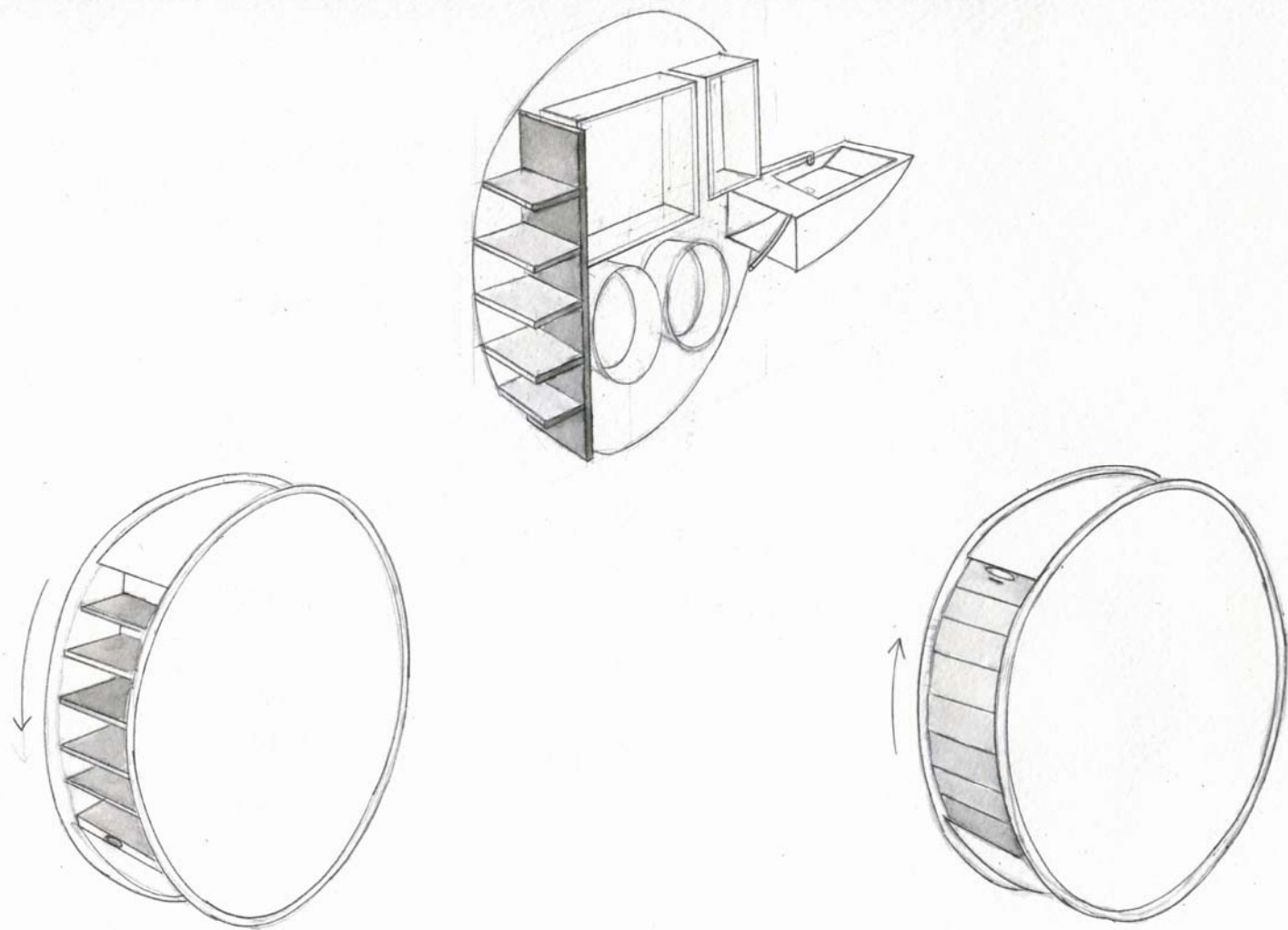
While the lower container holds used water, the upper container stores clean water. As long as the clean water got exhausted, the upper empty container could replace the lower one which is full of used-water. Meanwhile, it needs to install a new clean water container on the top.



## Section

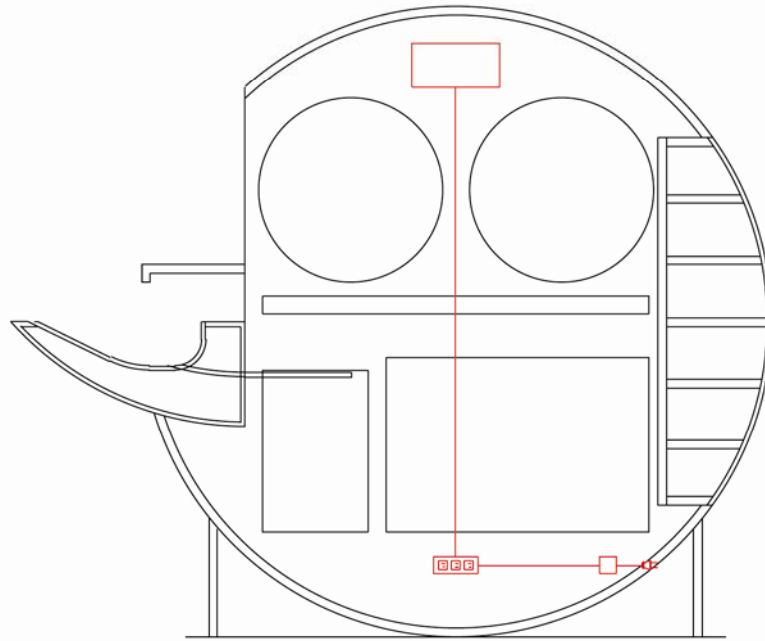


Cabinet



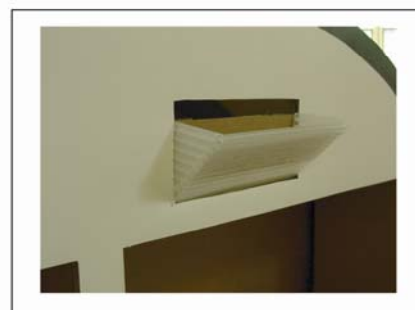
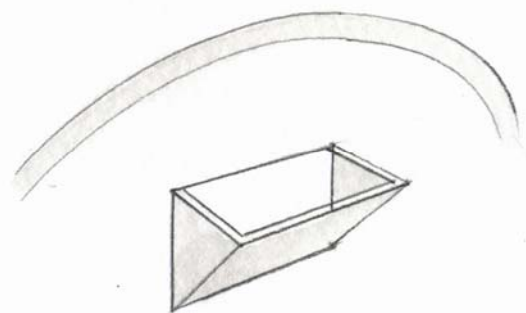
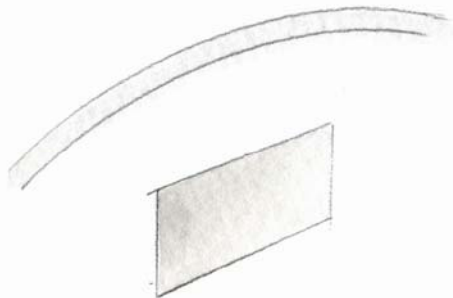
## ***Cord and Outlet***

The retractable electrical cord can be stored easily by simply pushing a button



## ***Light***

The general lights illuminate upward to avoid light glaring into dentists' eyes.

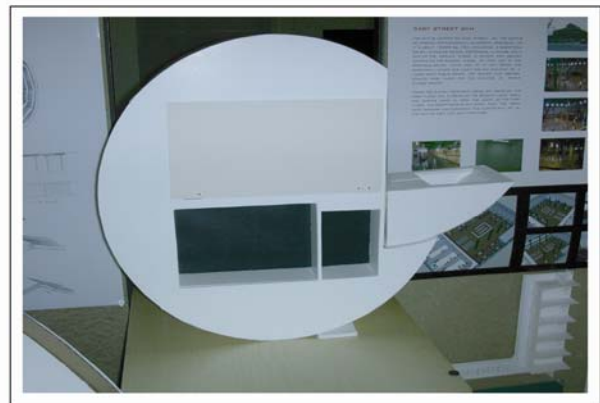
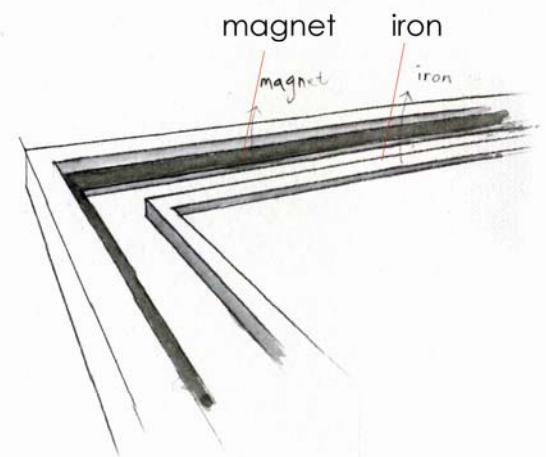
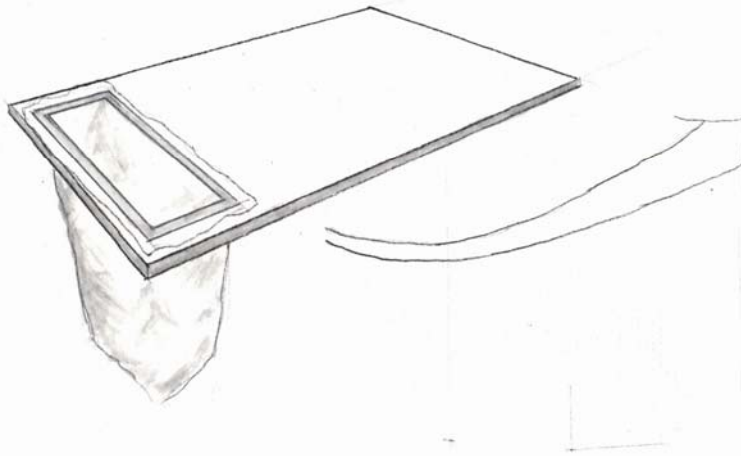




## Trash Rack

Trash rack is on the edge of the table.

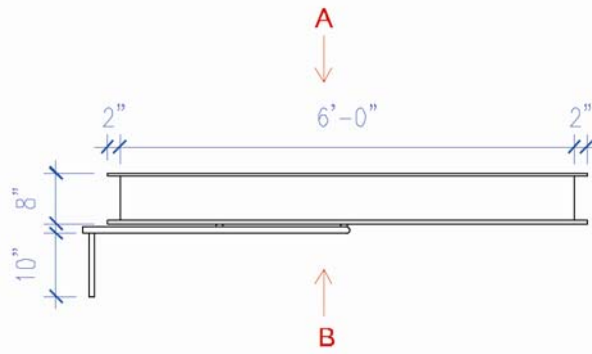
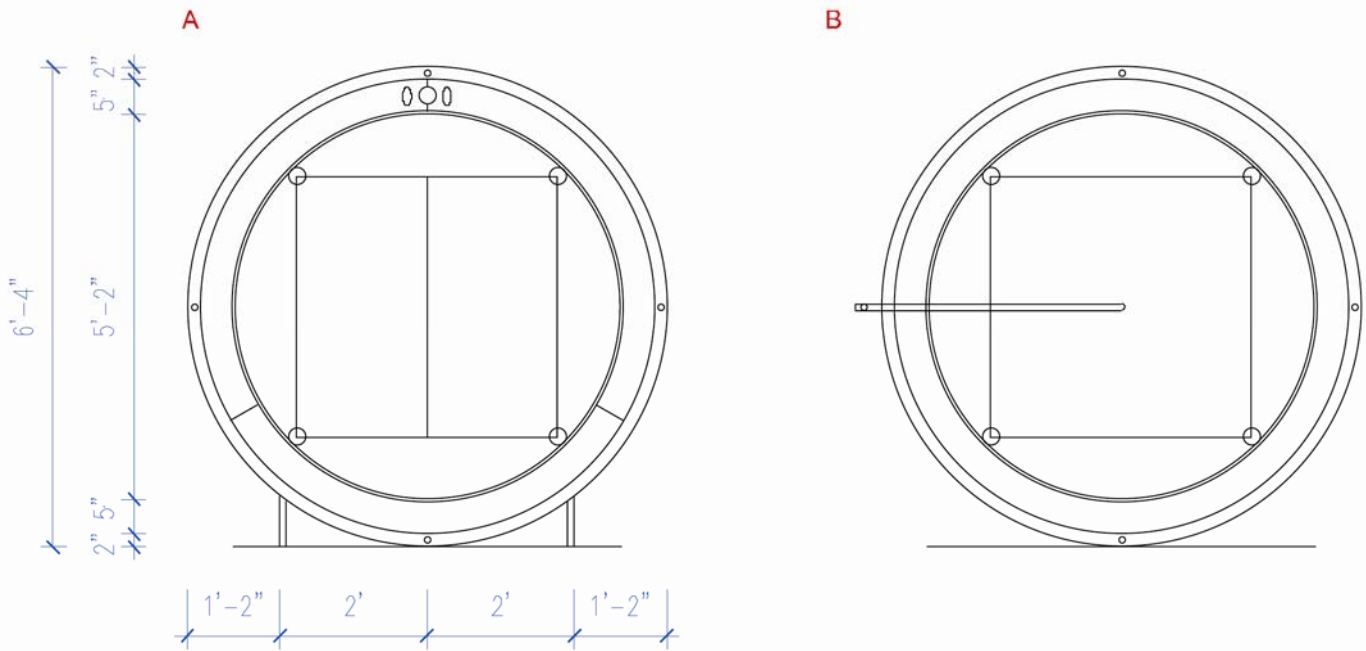
Trash rack on the edge of the table





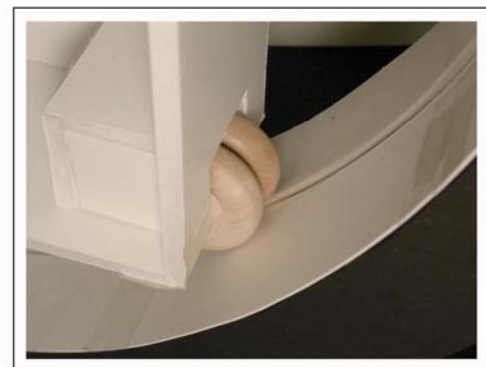
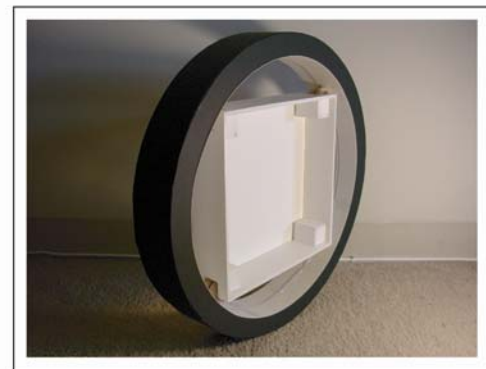
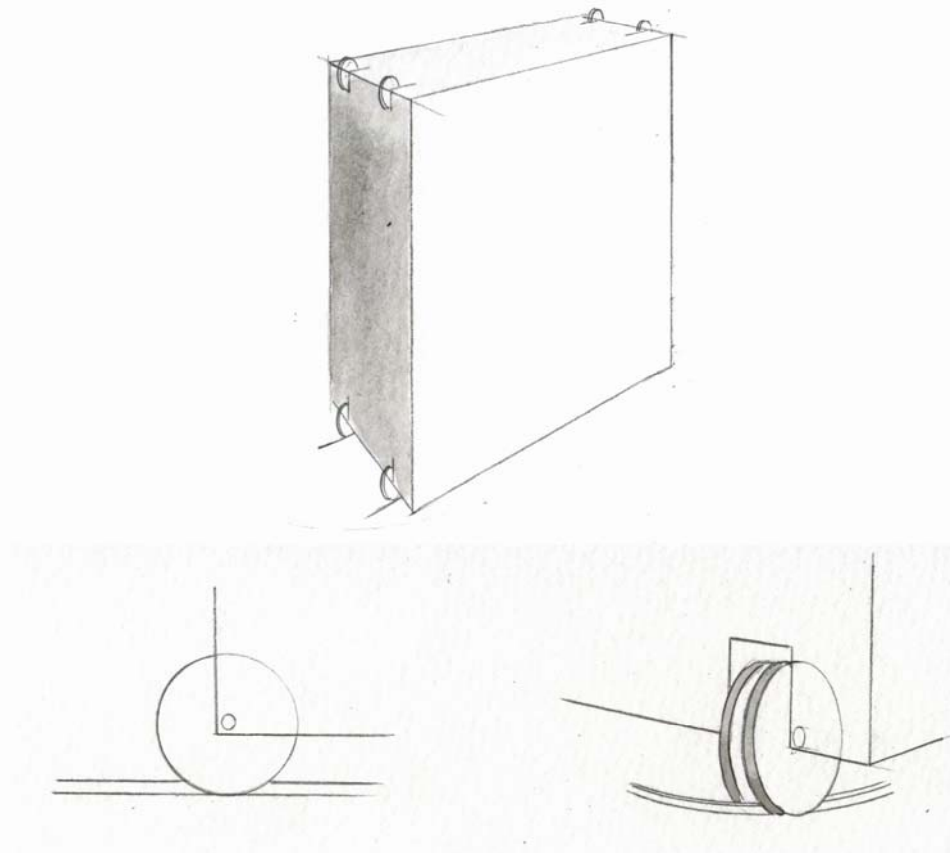


Outer Part

**Outer Part****Plan****Elevation**

## Wheels

The small wheels keep the container's balance during the transportation so the dental equipments would not be shaken or rotated.

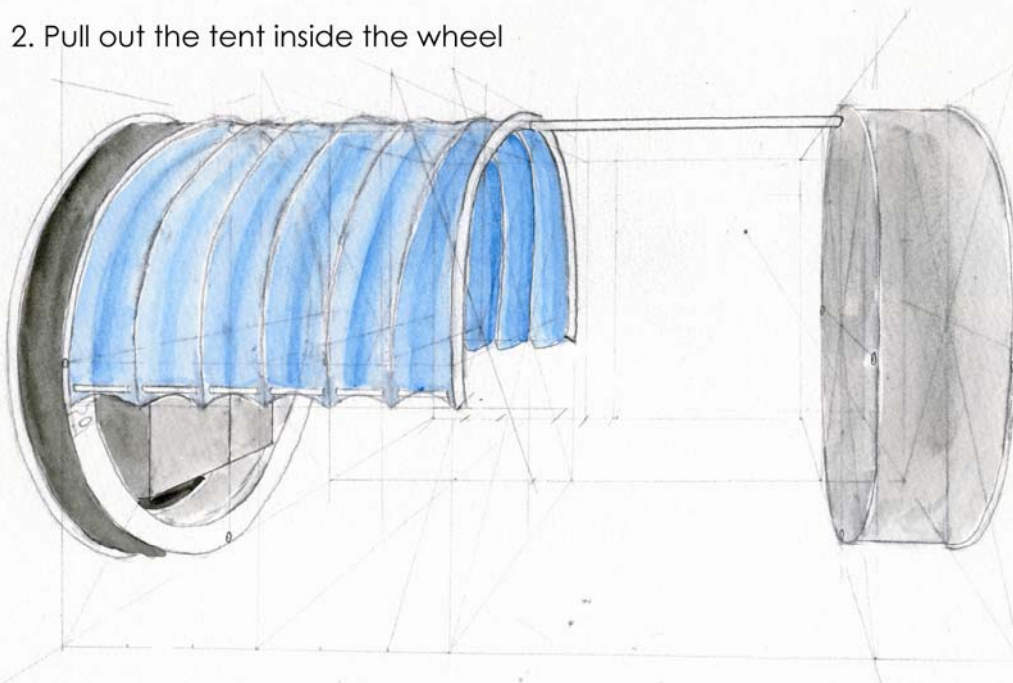


## Tent

1. Open the door

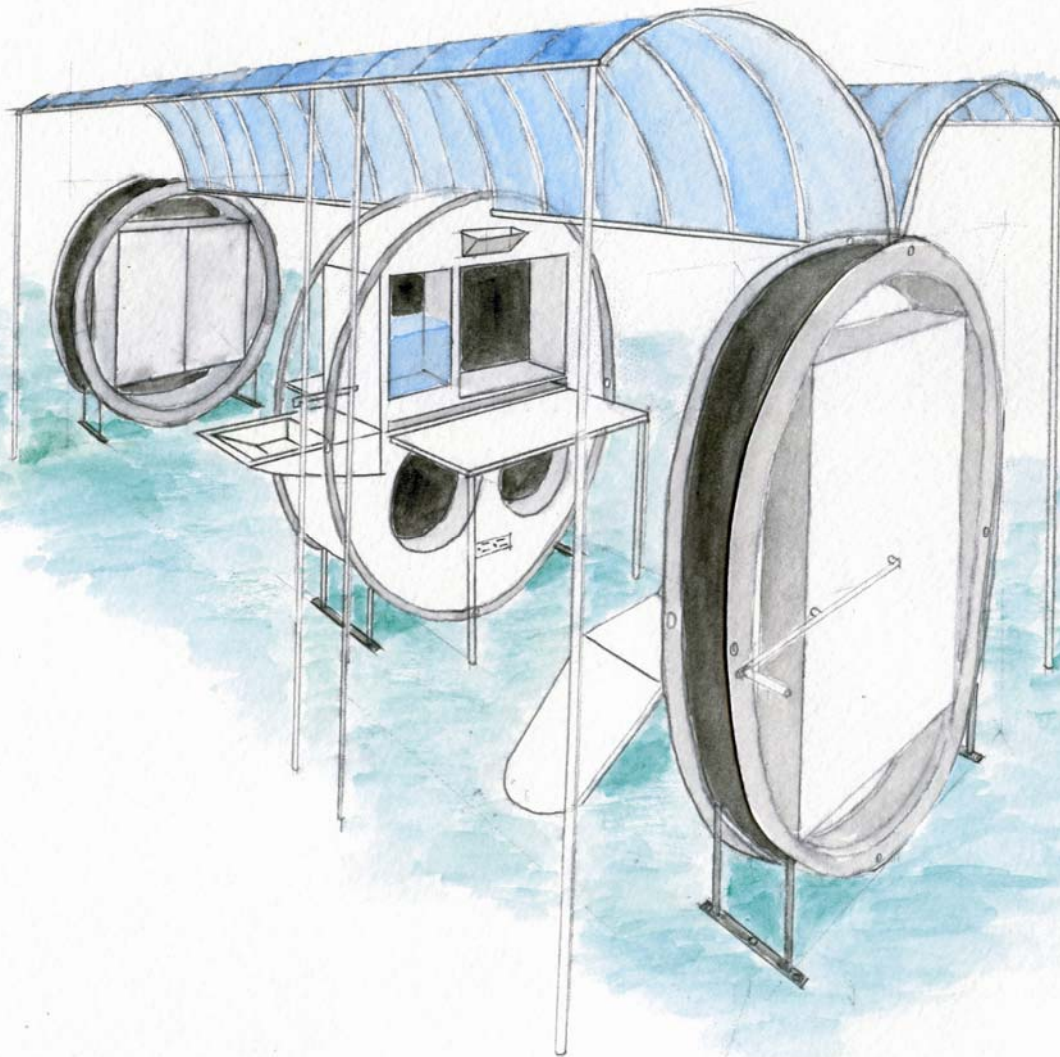


2. Pull out the tent inside the wheel



3. Close the door and let semicircular holes on the edge of the doors support the stick

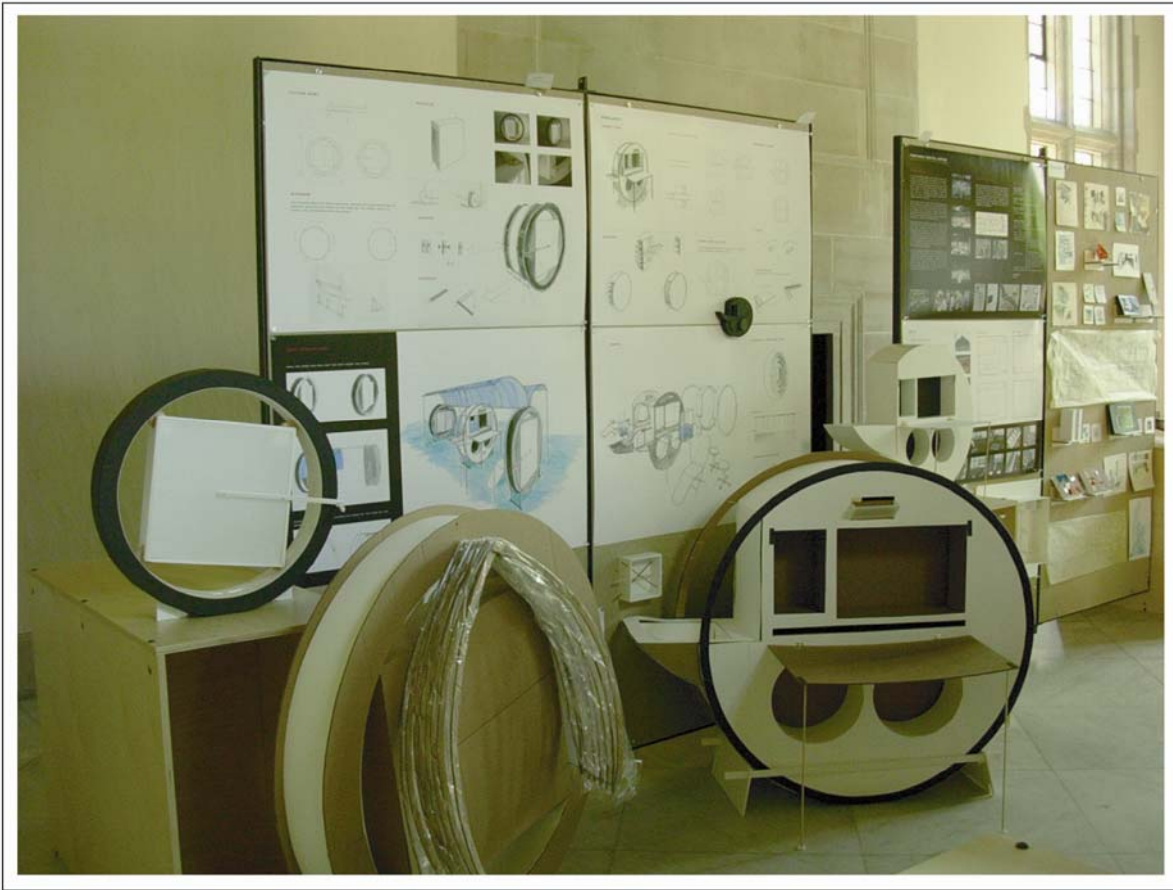
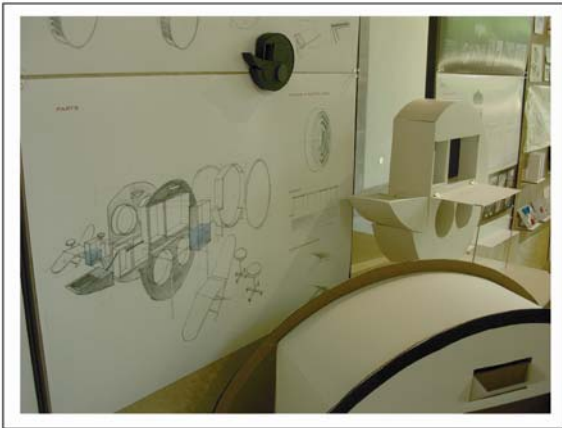








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